Correlates of Sunburn Experiences Among U.S. Adults: Results of the 2000 National Health Interview Survey

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SYNOPSIS

Objective. The purpose of this study was to determine the rate of sunburns in the U.S. adult population and the correlates of sunburns.

Methods. Data from the 2000 National Health Interview Survey Cancer Control Module were used to calculate the number of sunburns (0, 1, 2, or ≥3) experienced during the past year by age, sex, race/ethnicity, and skin sensitivity to sun exposure. The relationship between no sunburns vs. one or more sunburns and additional demographic, health, and behavioral factors for adults who self-identify as white Hispanic or white non-Hispanic was assessed using general linear contrasts. Multivariate logistic regression modeling was conducted to determine the most important covariates associated with sunburns. All analyses were weighted for the complex sampling design.

Results. The study data suggest that overall, 18.5% (95% confidence interval [CI] 17.9, 19.1) of U.S. adults experience one sunburn a year, 9.7% (95% CI 9.3, 10.1) experience two, and 8.0% (95% CI 7.6, 8.4) experience ≥3 sunburns. The data also indicate that adults who self-identify as white non-Hispanic experience sunburns more frequently than (in order of prevalence) those who identify as American Indian/Alaska Native, white Hispanic, Asian/Pacific Islander, or black. Sunburns were found to be more common among men than among women, more common among younger age groups than among older age groups, and more common among those with skin more prone to sunburn than among those with skin less prone to sunburn. Among individuals who self-identify as white Hispanic or white non-Hispanic, protective behaviors associated with lower rates of one or more sunburns in multivariate analyses are staying in the shade (odds ratio [OR] 0.73, 95% CI 0.66, 0.80) and wearing long-sleeved shirts (OR 0.86, 95% CI 0.75, 0.99).

Conclusions. Many American adults have one or more sunburns per year. Methods to protect from sun exposure may not be used as needed to prevent sunburn.

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There are an estimated one million new cases of skin cancer per year among adults and children in the United States, including basal and squamous cell carcinoma and melanoma. 1,2 The primary risk factors for the development of skin cancer include excessive exposure to ultraviolet (UV) radiation and personal characteristics associated with elevated skin sensitivity to UV radiation such as light skin color, easy sunburning, and little or no ability to tan.³ The protective behaviors recommended to reduce exposure to UV radiation include wearing protective clothing, staying in the shade, avoiding exposure during the mid-day hours (10 a.m. to 4 p.m.) when the UV rays from the sun are the strongest, and using sunscreen with a sun protection factor (SPF) of at least 15.1,4

Sunburn is an indicator of excessive sun exposure and therefore a risk marker for skin cancer, as well as an indicator of the effectiveness of prevention efforts. A history of sunburn, a measure of episodic UV exposure, is associated with elevated risk of melanoma and basal cell carcinoma, whereas cumulative UV exposure is important in the development of squamous cell carcinoma.^{3,5,6} Previous surveys in the U.S. have found sunburn rates for adults of all races in the range of 30% (1986) to 39% (1996), with a recent estimate of 32% (1999) of the population reporting sunburns.⁸ However, recent reports have not assessed sunburns in relation to important covariates, such as behaviors to protect from sun exposure.

We analyzed year 2000 data from the National Health Interview Survey⁹ (NHIS) to determine the prevalence of sunburns experienced by the U.S. adult population, by demographic characteristics. Further analyses examined correlates of sunburns, including behavioral factors.

METHODS

Participants in the 2000 NHIS were selected through a multistage sampling process to represent the civilian, noninstitutionalized household population of the United States. 9,10 Black and Hispanic populations were oversampled to allow for more precise estimates. A sample adult was randomly selected from each household to provide information for the Sample Adult Core file. Respondents who served as NHIS sample adults for each household also participated in the Cancer Control Module. NHIS data are collected by Census interviewers through computer-assisted inperson interviews using laptop computers.

A total of 32,374 individuals ages ≥18 years were interviewed, for a response rate of 72%. Although all sample adults initially were asked questions included

in the Cancer Control Module, some did not complete the module and were excluded from the analyses reported here (n=1,152, or 4% of sample adults).

The NHIS ascertained demographic characteristics, including age, sex, race/ethnicity, marital status, number of children in the household, and education.

The Cancer Control Module included the question, "How many times in the past year have you had a sunburn?" In addition, a person's sun sensitivity was ascertained for short sun exposure ("After several months of not being in the sun, if you went out in the sun without sunscreen, a hat, or protective clothing, for an hour, which one of these would happen to your skin?") and longer-term sun exposure ("If you were out in the sun for a long time repeatedly [such as every day for two weeks], which one of these would happen to your skin?"). Respondents were asked about various sun protection strategies, including staying in the shade, wearing hats and/or shirts, using sunscreen, and the SPF of the sunscreen. Responses to the sun protection questions were dichotomized as always or most of the time vs. sometimes, rarely, or never.

We assessed several additional potential covariates selected on the basis of their relationship to melanoma risk³ or their inclusion in a general health promotion and disease prevention behavioral profile. These were smoking behavior (current, former, never); excessive alcohol use (excessive alcohol drinkers were defined as those who reported having had ≥12 drinks of any alcoholic beverage in their lifetimes and reported having consumed ≥5 drinks on one occasion at least 12 times during the past 12 months)¹¹; access to health care (health insurance coverage and physician visit in the past year); health status; skin examinations (ever and recent, the latter categorized according to the recommendations of the American Cancer Society: every three years for ages 18–39 years; every year for ages ≥40 years); personal and family history of skin cancer; Body Mass Index (BMI; weight in kilograms divided by height in meters squared; categorized according to the International Obesity Task Force classification:¹² healthy weight = BMI <25; overweight = BMI $\geq 25 < 30$; obese BMI ≥ 30); physical activity (weighted sum of the minutes per week of moderate and vigorous activity):¹³ no activity = METS 0; some activity = METS >0 \leq 675; meet/exceeds recommended activity = METS 675; where METS = 4.5 times the number of minutes of moderate activity per week +7.0times the number of minutes of vigorous activity per week; work area (outdoors vs. indoors); region of residence (West, Midwest, South, Northeast); and time of interview (1st, 2nd, 3rd, or 4th quarter of the year).

Of the 31,222 adults with complete responses to the

Cancer Control Module, 1,759 indicated that they did not go out in the sun in response to the questions regarding protection from sun exposure. These 1,759 respondents were excluded from the analyses reported here, as they were not asked whether they had had a sunburn in the past year. Data on the number of sunburns in the past year were missing for an additional 585 respondents (226 refused to answer the question; 284 responded "don't know"; and no information was available for 75). Therefore, the analyses are based on 28,878 respondents.

The weighted prevalence of experiencing 0, 1, 2, or ≥3 sunburns was calculated by race/ethnicity, age, sex, and skin sensitivity to sun exposure. Rates were age-standardized to the 2000 U.S. standard million population. Race/ethnicity was self-reported and defined as white Hispanic, white non-Hispanic, black, Asian/Pacific Islander, American Indian/Alaska Native, or other. The number of respondents was too low to group black Hispanics independently, so they were combined with other black respondents. Further analyses explored the associations between no sunburns vs. one or more sunburns and various covariates for individuals who identify as either white Hispanic or white non-Hispanic. People identified as white have a much higher risk of sunburn and skin cancer than members of other racial groups.3 Statistical testing for differences in age-standardized sunburn rates was performed using general linear contrasts. 14,15 Multivariate logistic regression modeling was conducted to determine the most important covariates (p < 0.05) associated with no sunburns experienced in the past year vs. one or more. All of the demographics and covariates were used as independent variables in the modeling with the exceptions of area of work, SPF factor, and ever having had a skin exam. These covariates were not included due to missing data and/or collinearity. All analyses were performed using SAS (Version 8.2)14 and SUDAAN (Version 8.0)15 in order to take into account the complex, multistage design of NHIS and to allow for weighting of the estimates.

RESULTS

Overall, the data show that about 36% of U.S. adults experience one or more sunburns a year (Table 1). About half of those who experience sunburns have one sunburn (18.5% of all adults); the remainder have two or more sunburns. Sunburns are most commonly reported among people who self-identify as white non-Hispanic, followed by (in order of prevalence) those who self-identify as American Indian/Alaska Native,

white Hispanic, Asian/Pacific Islander, and black. People in younger age groups are more likely than people in older age groups to report having sunburns, men are more likely than women, and those reporting sun-sensitive skin (reaction to short and longer term sun exposure) are more likely than those who reported having skin that is not sun-sensitive.

Among people who self-identify as white Hispanic or white non-Hispanic, the likelihood of experiencing one or more sunburns differs by education, level of physical activity, and BMI (Table 2). Sunburns are more frequently reported in the second and third quarters of the year than the fourth. Those living in the Midwest report sunburns more frequently than those living in other regions. While sunburns are more common among those who are more likely to use hats, sunscreen, and sunscreen with an SPF of >15 than among those who are unlikely to use these sun protection measures, sunburns are less common among those who are likely to stay in the shade or to wear longsleeved shirts. Having had a skin exam, a recent skin exam, or a physician visit within the past year; a family history of melanoma; health care coverage; and reporting of excellent or good health status all are associated with a higher frequency of self-reported sunburns. Former smokers have more sunburns than never or current smokers, and those with a history of excessive alcohol use are more likely to have sunburns than those without such a history.

In the multivariate analyses, the only sun protection behaviors that remained important predictors of one or more sunburns among people who self-identify as white were staying in the shade and wearing longsleeved shirts (Table 3). Other covariates associated with reporting one or more sunburns in the multivariate model included skin sensitivity to short-term sun exposure, younger age, male sex, higher physical activity, not being of Hispanic ethnicity, geographic region of residence (Midwest or West), higher BMI, excessive alcohol use, a family history of melanoma, physician visit in the past year, and having health insurance coverage. Individuals who were widowed reported sunburns less frequently than individuals who were married or living with a partner. Although the number of children in the household was associated with reported sunburns, there was no clear trend. Finally, the time of year the interview was conducted was associated with reported sunburns; sunburns were more frequently reported in the 1st, 2nd, or 3rd quarter of the year than in the 4th quarter.

Table 1. Weighted prevalence of sunburns within the past year among U.S. adult population, by self-reported demographic characteristics and sun sensitivity, NHIS 2000

	Nu	ımber of sunburns in	past year (weighted	n)
	0 (n=19,022)	1 (n=5,043)	2 (n=2,633)	≥3 (n=2,180)
Characteristic	Percent (95% CI)	Percent (95% CI)	Percent (95% CI)	Percent (95% CI)
Age (years)				
18–29	49.2 (47.5, 50.8)	22.2 (20.8, 23.5)	13.9 (12.8, 15.0)	14.8 (13.6, 15.9)
30–39	52.3 (50.7, 53.8)	24.5 (23.2, 25.7)	12.8 (11.8, 13.7)	10.5 (9.6, 11.4)
40–49	59.5 (58.1, 61.0)	22.1 (20.8, 23.3)	11.0 (10.1, 11.9)	7.4 (6.6, 8.2)
50–64	73.6 (72.3, 75.0)	15.4 (14.3, 16.5)	6.8 (6.0, 7.5)	4.2 (3.6, 4.8)
≥65	88.9 (87.9, 89.9)	6.3 (5.6, 7.1)	2.9 (2.3, 3.4)	1.9 (1.5, 2.4)
Sex				
Male	62.3 (61.2, 63.3)	18.5 (17.7, 19.3)	10.2 (9.5, 10.8)	9.0 (8.4, 9.6)
Female	65.1 (64.1, 66.0)	18.5 (17.8, 19.2)	9.3 (8.8, 9.9)	7.1 (6.5, 7.6)
Race				
White Hispanic	77.0 (74.9, 79.0)	11.6 (10.2, 13.0)	6.2 (5.3, 7.2)	5.2 (4.2, 6.2)
White non-Hispanic	56.3 (55.4, 57.1)	22.0 (21.3, 22.7)	11.8 (11.2, 12.3)	9.9 (9.4, 10.5)
Black	90.5 (89.4, 91.6)	5.0 (4.2, 5.9)	2.7 (2.1, 3.2)	1.8 (1.3, 2.2)
Asian/Pacific Islander	81.5 (78.1, 84.9)	9.9 (7.5, 12.3)	4.7 (2.8, 6.6)	3.9 (2.5, 5.3)
American Indian/Alaska Native	71.3 (65.5, 77.1)	17.1 (11.7, 22.4)	6.6 (3.2, 10.0)	5.0 (1.4, 8.6)
Other/multiracial	74.9 (72.0, 77.8)	13.1 (10.9, 15.3)	5.5 (4.2, 6.8)	6.5 (4.4, 8.6)
Sun sensitivity: short exposure				
Severe burn	47.7 (46.4, 49.0)	23.4 (22.3, 24.6)	14.5 (13.6, 15.4)	14.4 (13.4, 15.3)
Mild burn	52.2 (50.8, 53.5)	24.4 (23.3, 25.6)	13.2 (12.4, 14.1)	10.2 (9.4, 11.0)
Turn darker/no burn	81.9 (81.0, 82.7)	11.4 (10.6, 12.2)	4.2 (3.7, 4.7)	2.5 (2.2, 2.8)
Do not go out in sun	91.0 (88.2, 93.8)	5.2 (3.1, 7.2)	2.7 (0.8, 4.5)	1.2 (0.0, 2.3)
Sun sensitivity: repeated exposure				
Freckles/repeated sunburn	50.2 (48.6, 51.9)	19.3 (18.0, 20.7)	14.2 (13.0, 15.4)	16.3 (14.9, 17.6)
Mild tan	63.1 (61.7, 64.5)	18.6 (17.5, 19.7)	10.4 (9.5, 11.3)	7.9 (7.1, 8.8)
Moderate tan	60.4 (59.2, 61.7)	21.1 (20.0, 22.2)	10.7 (9.9, 11.5)	7.8 (7.1, 8.4)
Deep tan	68.1 (66.7, 69.4)	18.5 (17.3, 19.7)	7.5 (6.8, 8.2)	5.9 (5.3, 6.6)
Do not go out in sun	86.8 (84.5, 89.1)	8.0 (6.2, 9.8)	3.5 (2.1, 4.9)	1.7 (0.7, 2.7)
Total	63.7 (63.0, 64.5)	18.5 (17.9, 19.1)	9.7 (9.3, 10.1)	8.0 (7.6, 8.4)

CI = confidence interval

DISCUSSION

The data suggest that a large proportion (36%) of U.S. adults have one or more sunburns a year. This episodic UV exposure may put these individuals at risk for developing melanoma and basal cell carcinoma, and may be part of cumulative UV exposure that is associated with squamous cell carcinoma.^{3,5,6} Overall, the rate of sunburns was somewhat higher than was reported using data from the Behavioral Risk Factor Surveillance System for 1999 (32%).8 Although their

results were not directly comparable to our results because of different methodologies and reference times for sunburns, 16 earlier surveys found U.S. sunburn rates of 30% (1986) and 39% (1996).7 Sunburn rates in other countries included 50% for a two-month period in 1996 in Canada, 17 16% in Australia for the preceding weekend in 1988,18 and 20% in 1992.19

In the present study, self-report of sunburns was associated with higher sun sensitivity to the skin, non-Hispanic ethnicity, young age, and male sex, similar to

Table 2. Correlates of having experienced at least one sunburn within the past year, U.S. white adult population, NHIS, 2000

	Total (N=22,627)	Males (n=10,220)	Females (n=12,407)	
Characteristic	Percent (95% CI)	Percent (95% CI)	Percent (95% CI)	
Education (p<0.001)				
< High school	31.7 (29.6, 33.8)	32.7 (29.9, 35.5)	30.7 (28.3, 33.2)	
High school graduate/GED	40.1 (38.8, 41.5)	40.5 (38.4, 42.6)	40.0 (38.3, 41.8)	
Some college/technical school	43.7 (42.4, 45.0)	46.3 (44.4, 48.2)	41.5 (39.7, 43.2)	
College graduate	46.7 (45.3, 48.0)	51.0 (49.1, 52.9)	42.1 (40.0, 44.2)	
Work area (<i>p</i> =0.079)	, , ,	, , ,	, , ,	
Mainly indoors	44.4 (43.2, 45.7)	46.8 (44.9, 48.6)	42.5 (40.9, 44.2)	
Mainly outdoors	40.8 (37.4, 44.2)	41.4 (37.6, 45.2)	37.5 (30.1, 44.9)	
In a motor vehicle	49.3 (43.2, 55.4)	48.6 (41.7, 55.4)	53.7 (37.8, 69.5)	
Other	44.8 (40.8, 48.9)	43.8 (39.3, 48.3)	47.7 (39.6, 55.8)	
Marital status (p=0.121)	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	(**************************************	(
Married/living with partner	41.8 (40.9, 42.8)	44.4 (43.0, 45.8)	39.3 (38.1, 40.5)	
Divorced/separated	39.6 (37.2, 42.0)	43.3 (39.5, 47.1)	37.2 (34.2, 40.1)	
Widowed	34.8 (25.4, 44.3)	47.9 (35.9, 59.9)	28.0 (15.9, 40.0)	
Never married	40.1 (37.9, 42.3)	39.8 (36.9, 42.8)	40.7 (38.0, 43.5)	
Number of children in household (p=0.009			(2212) 1010)	
0	42.2 (41.1, 43.2)	43.5 (42.0, 44.9)	41.1 (39.7, 42.6)	
1	40.8 (38.5, 43.0)	40.9 (37.8, 43.9)	40.7 (37.6, 43.7)	
2	48.0 (44.5, 51.5)	53.9 (49.2, 58.5)	40.2 (36.1, 44.4)	
3	42.2 (36.8, 47.5)	48.1 (39.7, 56.5)	37.1 (31.5, 42.7)	
≥4	36.9 (29.3, 44.5)	35.8 (26.4, 45.3)	38.8 (24.8, 52.8)	
Time of interview (p=0.002)	, , ,			
1st quarter	41.5 (39.9, 43.1)	44.2 (42.0, 46.4)	39.1 (37.0, 41.3)	
2nd quarter	43.5 (42.1, 44.8)	45.4 (43.3, 47.4)	41.7 (39.7, 43.6)	
3rd quarter	42.2 (40.6, 43.8)	44.7 (42.6, 46.7)	39.8 (37.8, 41.8)	
4th quarter	39.2 (37.5, 40.8)	39.5 (37.1, 41.9)	39.0 (37.0, 40.9)	
Region (p<0.001)				
Northeast	40.3 (38.2, 42.4)	41.7 (39.1, 44.3)	39.2 (36.6, 41.9)	
Midwest	47.2 (45.7, 48.7)	49.7 (47.3, 52.1)	44.9 (43.1, 46.8)	
South	37.6 (36.2, 39.1)	39.3 (37.3, 41.3)	36.0 (34.1, 37.9)	
West	41.5 (40.0, 43.1)	43.2 (41.0, 45.5)	39.8 (37.6, 42.1)	
Stay in shade (<i>p</i> <0.001)				
Always/most of the time	39.1 (37.7, 40.6)	42.9 (40.6, 45.2)	36.9 (35.1, 38.7)	
Sometimes/rarely/never	43.2 (42.2, 44.2)	44.2 (42.8, 45.5)	42.0 (40.8, 43.3)	
Wear hat (p=0.030)				
Always/most of the time	43.4 (41.9, 44.9)	47.3 (45.3, 49.2)	36.8 (34.3, 39.2)	
Sometimes/rarely/never	41.4 (40.5, 42.4)	42.3 (40.8, 43.7)	40.9 (39.7, 42.1)	
Wear long-sleeved shirt (p<0.001)	, ,		. , , ,	
Always/most of the time	36.9 (34.5, 39.4)	39.6 (36.1, 43.1)	34.0 (30.4, 37.6)	
Sometimes/rarely/never	42.4 (41.6, 43.3)	44.1 (42.8, 45.3)	40.9 (39.9, 42.0)	
Use sunscreen (p<0.001)	. , ,	. ,	. , ,	
Always/most of the time	45.7 (44.4, 46.9)	51.8 (49.5, 54.1)	42.5 (41.1, 44.0)	
Sometimes/rarely/never	40.1 (39.1, 41.0)	41.4 (40.2, 42.7)	38.3 (37.0, 39.6)	
Use SPF \geq 15 (p <0.001)	, , , , , , , , , , , , , , , , , , , ,	, , , , , , ,	,,,	
Yes	47.7 (46.7, 48.7)	53.4 (51.7, 55.0)	43.9 (42.5, 45.2)	
No	35.3 (34.1, 36.6)	36.0 (34.5, 37.6)	34.4 (32.8, 36.0)	

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Table 2 (continued). Correlates of having experienced at least one sunburn within the past year, U.S. white adult population, NHIS, 2000

	Total (N=22,627)	Males (n=10,220)	Females (n=12,407)
Characteristic	Percent (95% CI)	Percent (95% CI)	Percent (95% CI)
Recent skin exama (p<0.001)			
Yes	46.4 (43.8, 49.0)	50.6 (46.6, 54.5)	43.3 (40.0, 46.6)
No	41.3 (40.4, 42.1)	43.0 (41.8, 44.1)	39.7 (38.6, 40.7)
Ever had skin exam (p <0.001)	, ,	, , , , , , , , , , , , , , , , , , , ,	(**************************************
Yes	46.3 (44.4, 48.3)	50.0 (47.0, 53.1)	43.2 (40.6, 45.8)
No	41.0 (40.1, 41.8)	42.6 (41.4, 43.8)	39.5 (38.4, 40.6)
Smoking status (p<0.001)	, , , , , , , , , , , , , , , , , , , ,	, , , , , , , , , , , , , , , , , , , ,	()
Current	39.1 (37.8, 40.5)	40.6 (38.7, 42.5)	37.4 (35.5, 39.3)
Former	44.2 (42.7, 45.8)	44.8 (42.4, 47.3)	43.2 (41.0, 45.5)
Never	41.6 (40.5, 42.7)	44.6 (42.9, 46.3)	39.6 (38.3, 41.0)
Excessive alcohol use (p <0.001)	(,,	(/ /	07.0 (00.0) 1.10)
Yes	50.3 (47.4, 53.1)	50.9 (47.8, 54.0)	44.9 (40.0, 49.8)
No	40.8 (39.9, 41.6)	42.2 (40.9, 43.4)	39.6 (38.5, 40.7)
Physical activity ^b (p<0.001)		12.2 (1017) 1011)	07.0 (00.0) .0.7
No activity	32.3 (31.0, 33.6)	33.0 (31.1, 35.0)	31.7 (30.0, 33.3)
Moderate activity	44.5 (42.9, 46.1)	47.1 (44.5, 49.7)	42.4 (40.5, 44.4)
Meet/exceed recommendations	46.4 (45.3, 47.5)	48.5 (46.9, 50.0)	44.3 (42.8, 45.7)
Body Mass Index (p<0.001)	10.1 (10.0, 17.0)	10.0 (10.7, 00.0)	11.5 (12.6, 15.7)
<25	39.7 (38.5, 41.0)	41.8 (39.8, 43.9)	38.6 (37.1, 40.0)
≥25<30	42.9 (41.6, 44.2)	44.6 (43.0, 46.2)	40.3 (38.5, 42.2)
≥30 ≥30	44.4 (42.8, 45.9)	45.1 (42.6, 47.5)	43.9 (41.9, 45.9)
History of melanoma (p=0.122)	11.1 (12.0, 10.7)	10.1 (12.0, 17.0)	10.7 (11.7, 10.7)
Yes	51.4 (38.9, 63.9)	60.3 (46.8, 73.8)	40.8 (22.3, 59.3)
No	41.5 (40.6, 42.3)	43.2 (42.1, 44.4)	39.8 (38.8, 40.9)
History of non-melanoma skin cancer (p=		10.2 (12.1, 11.1)	07.0 (00.0, 10.7)
Yes	43.5 (31.6, 55.3)	51.3 (31.6, 70.9)	38.1 (23.6, 52.5)
No	41.4 (40.6, 42.3)	43.2 (42.1, 44.4)	39.8 (38.8, 40.9)
History of unknown type skin cancer ($p=$		10.2 (12.1, 11.1)	07.0 (00.0, 10.7)
Yes	56.7 (42.9, 70.5)	69.1 (53.6, 84.5)	41.8 (21.9, 61.8)
No	41.5 (40.7, 42.3)	43.3 (42.1, 44.4)	39.8 (38.8, 40.9)
Family history of melanoma (p<0.001)	11.3 (10.7, 12.3)	10.0 (12.1, 11.1)	07.0 (00.0, 10.7)
Yes	52.5 (47.3, 57.6)	62.6 (57.0, 68.2)	45.2 (37.7, 52.7)
No	41.7 (40.8, 42.5)	43.5 (42.4, 44.7)	39.9 (38.8, 40.9)
Health care coverage (p<0.001)	41.7 (40.0, 42.3)	45.5 (42.4, 44.7)	37.7 (30.0, 40.7)
Yes	43.1 (42.3, 44.0)	45.4 (44.2, 46.7)	41.0 (39.9, 42.2)
No	35.5 (32.5, 38.5)	34.7 (31.2, 38.2)	36.3 (32.0, 40.6)
Physician visit in past year ($p<0.001$)	00.0 (02.0, 00.0)	01.7 (01.2, 00.2)	00.0 (02.0, 40.0)
Yes	43.0 (42.1, 43.9)	45.3 (44.1, 46.6)	41.1 (40.0, 42.3)
No	36.9 (35.2, 38.6)	39.8 (37.7, 41.9)	30.8 (28.0, 33.6)
Health status (p <0.001)	30.7 (33.2, 30.0)	37.0 (37.7, +1.7)	30.0 (20.0, 33.0)
Excellent/good	42.2 (41.3, 43.0)	44.3 (43.1, 45.5)	40.2 (39.1, 41.3)
Fair/poor	35.6 (32.8, 38.4)	33.9 (29.1, 38.7)	37.4 (34.1, 40.7)
ι απτροσι	33.0 (32.0, 30.4)	33.7 (27.1, 30.7)	37.4 (34.1, 40.7)

NOTE: The *p*-values show the statistical significance of differences in sunburn prevalence (≥1 vs. none) for males and females

^aEvery three years for individuals 18–39 years of age; every year for individuals ≥40 years of age

^bDefined as the weighted sum of the minutes per week of vigorous and moderate activity.

CI = confidence interval

Table 3. Multivariate model: association between selected covariates and having experienced one or more sunburns in the past year among U.S. white adults

Characteristic	OR ^a	95% CI	p-value
Sun sensitivity: short exposure			<0.001
Severe sunburn vs. tan/nothing	4.71	4.20, 5.29	
Mild sunburn vs. tan/nothing	3.69	3.31, 4.12	
Don't go out vs. tan/nothing	0.73	0.50, 1.07	
Age (years)			< 0.001
30–39 vs. 18–29	0.66	0.58, 0.75	
40-49 vs. 18-29	0.44	0.38, 0.50	
50-69 vs. 18-29	0.23	0.20, 0.27	
≥70 vs. 18–29	0.09	0.08, 0.11	
Physical activity ^b			< 0.001
Some activity vs. no activity	1.45	1.30, 1.62	
Meet/exceed recommended activity vs. no activity	1.58	1.44, 1.74	
Hispanic ethnicity	0.48	0.41, 0.57	< 0.001
Region			< 0.001
Northeast vs. South	1.00	0.88, 1.14	
Midwest vs. South	1.41	1.26, 1.57	
West vs. South	1.33	1.18, 1.50	
Body Mass Index ^c			< 0.001
Overweight vs. normal	1.22	1.10, 1.34	
Obese vs. normal	1.42	1.29, 1.57	
Excessive alcohol use	1.65	1.43, 1.91	< 0.001
Stay in shade			< 0.001
Always/most of the time vs. sometimes/rarely/never	0.73	0.66, 0.80	
Sex			< 0.001
Female vs. male	0.80	0.73, 0.88	
Interview quarter			0.001
1st vs. 4th	1.13	1.00, 1.27	
2nd vs. 4th	1.27	1.13, 1.42	
3rd vs. 4th	1.13	1.01, 1.27	
Physician visit in past year	1.20	1.08, 1.34	0.001
Number of children in household			0.002
1 vs. 0	0.94	0.84, 1.05	
2 vs. 0	1.21	1.07, 1.37	
3 vs. 0	1.20	1.02, 1.41	
4 or more vs. 0	1.07	0.83, 1.37	
Marital status			0.014
Divorced/separated vs. married/living with partner	0.98	0.88, 1.10	
Widowed vs. married	0.76	0.64, 0.90	
Never married vs. married	1.03	0.90, 1.17	
Any health insurance coverage	1.15	1.03, 1.29	0.014

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Table 3 (continued). Multivariate model: association between selected covariates and having experienced one or more sunburns in the past year among U.S. white adults

Characteristic	OR ^a	95% CI	p-value
Family history of melanoma	1.42	1.07, 1.88	0.016
Wear long-sleeved shirt			0.032
Always/most of the time vs. sometimes/rarely/never	0.86	0.75, 0.99	
General health status			0.066
Good/excellent vs. fair/poor	1.15	0.99, 1.32	
Sunscreen			0.106
Always/most of the time vs. sometimes/rarely/never	1.07	0.98, 1.17	
Wear hat			0.187
Always/most of the time vs. sometimes/rarely/never	1.07	0.97, 1.19	
Education attainment			0.299
High school graduate/GED vs. < high school graduate	1.03	0.89, 1.18	
Some college/technical school vs. < high school graduate	1.11	0.96, 1.28	
College graduate vs. < high school graduate	1.10	0.95, 1.28	
Recent skin exam	0.99	0.86, 1.14	0.916
Smoking status			0.962
Current vs. never	0.99	0.90, 1.09	
Former vs. never	1.00	0.91, 1.11	

^aOdds ratios adjusted for all other variables in model.

OR = odds ratio

CI = confidence interval

the covariates found to be related to use of methods to protect from sun exposure²⁰ and consistent with the results of earlier studies of sunburns.^{8,19,21} The tendency to sunburn is related to the melanin content of the skin; therefore, white non-Hispanic individuals are at highest risk. One study found that about 6% of African Americans reported having sun-sensitive skin with a tendency to severe sunburns, and 9% reported a tendency for mild sunburns.²² In NHIS, sun sensitivity was a self-reported measure, and the experience of sunburns can influence this self-assessment.²³

For white adults, staying in the shade and wearing long-sleeved shirts were the only protective methods associated with fewer reports of sunburns. An earlier study from Canada found nonsignificant inverse associations between sunburn and seeking of shade and use of protective clothing.²¹ In the present study, use of sunscreen or hats was not significantly associated with reporting of sunburns in the multivariate model.

A nonsignificant, positive association between sunscreen and sunburn was reported from the Canadian study.²¹ Those who use sunscreen or hats may spend a lot of time in the sun or use these methods after experiencing sunburns to protect from further sun damage.²⁴ Sunscreen use may exacerbate sunburns by providing a rationale for people to spend a longer time exposed to the sun. At this time, there is insufficient evidence to determine whether the use of sunscreens can reduce the risk of basal cell carcinoma or melanoma. However, use of sunscreens can reduce the risk of sunburn and possibly of squamous cell carcinoma.²⁵ There is no evidence that sunscreen use increases the risk of melanoma.²⁶

People who are physically more active may spend more time outdoors exposed to the sun, and therefore may be more likely to experience sunburns. A study in San Diego, California, found that 54% of residents who spent time outdoors for recreation ac-

 $^{^{}b}$ No activity = METS 0, some activity = METS >0≤675, meet/exceeds recommended activity = METS >675, where METS = 4.5 times the number of minutes of moderate activity per week + 7.0 times the number of minutes of vigorous activity per week.

 $^{^{}c}$ Healthy weight = BMI <25, overweight = BMI \geq 25<30, obese = BMI >30.

tively sought to tan.²⁷ In a 1996 U.S. population survey, 25% of respondents reported that they intentionally worked on a tan.⁷ Intentional tanning was more commonly reported by white respondents than by non-whites; it was also reported most often by people in younger age groups and those residing in the North Central U.S.

A family history of melanoma is a risk factor for the development of melanoma.³ In addition to a possible genetic component, however, there is likely a shared photosensitive skin profile and there may also be an environmental component in that members of such families may spend more time in the sun. Greater sun exposure may interact with greater skin sensitivity to increase cancer risk. It is unclear whether our finding of an association between sunburns and a family history of melanoma indicates a lack of knowledge of the complex interplay between genetic or phenotypic susceptibility, sun exposure, and melanoma risk.

Earlier surveys found that a large proportion of the U.S. population (56% in 1996) believes that people with tans look healthier than people without tans.⁷ This attitude may be the reason that we found associations between sunburns and indicators such as physical activity, physician visit in the past year, and health insurance coverage. On the other hand, the relationships between sunburns and higher BMI or excessive alcohol use suggest a general lack of a healthy lifestyle. Obesity has been identified as a possible risk factor for melanoma;²⁸ however, the relationships between sun exposure, obesity, and melanoma have not been explored. More information is needed in this area, and our finding could be a spurious one.

The strengths of this study include a high response rate and the availability of information on important covariates, including behaviors to protect from sun exposure. One limitation is the self-reported nature of the information on sunburns. While recall may be less reliable over a longer time period, asking respondents about longer time periods prevents variations due to weather, UV radiation levels, or attitudes that may influence shorter recall periods.¹⁶ The time of year of the interview was associated with reported sunburns, although the differences between quarters were not large. Sunburns are relatively memorable and distinct events, which makes them easy to recall. Therefore, general estimates of the risk of melanoma and basal cell cancer associated with sunburns may be derived from these data, as these cancers are associated with episodic UV exposure.3,5,6 Future U.S. studies should consider collecting more detailed information, such as the body sites where sunburns occur and the extent of protection of all body sites. 19 To allow for a comparison of the results of different surveys, measures of sunburn should be standardized. Another limitation of the present study is that we did not know whether protective behaviors preceded or followed sunburns. Finally, data were not available to determine whether physical activity occurred indoors or outdoors.

In summary, these data suggest that seeking shade and wearing long-sleeved shirts are key behaviors that help in avoiding sunburn in people who self-identify as white. Sunburn rates along with estimates of the use of protective methods are important indicators of the risk of skin cancer and of the effectiveness of preventive interventions.

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